

Remarks

General:

Claims 49-66 are pending in the application.

Specification:

The specification was objected to because an incorrect location was given for the newly-inserted brief description of FIG. 5. Applicant's attorney apologizes for the error, which is now corrected.

Claim objections:

Claim 49 is objected to because the claim seemed to assume but did not actually state that the results from step i) were used in creating the model in step ii). Claim 49, step ii) is now amended to use explicitly the results of step i).

Claim 57 is corrected as requested by the Examiner.

35 U.S.C. § 112 rejections:

Claims 52, 57-64 were rejected on the ground that "processing means such as a computer" in claims 52 and 57 was of unclear scope. The expression "such as a computer" is now deleted. To avoid a question whether deleting the structure "computer" turns "processing means" into a means-plus-function element, it has been changed to the structural "processor."

Claim 57 was rejected on the ground that it appeared to disagree with claim 49 as to whether the computer model was required to be used to calculate the integrity value. Applicant does not consider that the disagreement give rise to a ground of rejection, because it is common for different independent claims to be of slightly different scope. However, in the interests of speedy prosecution claim 57 has been amended to agree more closely with claim 49.

Claim 57 was rejected on the ground that it was unclear which of load data and dimension data was referred to as "said data" in lines 8 and 10. By analogy with claim 49, claim 57 is amended to specify both sorts of data.

A number of other issues were raised in respect of claim 57 in paragraph 15 of the Office action. These are believed to be moot in view of the amendments already discussed. If the

examiner has any remaining concerns about the clarity of claim 57, she is respectfully requested to telephone the undersigned so that the matter can be resolved.

It is believed to be clear from the quantities being measured in claims 59-64 that the sensors involved are the second sensors. That has been stated explicitly.

35 U.S.C § 103:

Claims 49-54, 56-59, and 61-66, of which claims 49 and 56 are independent, are rejected as allegedly obvious over U.S. Patent No. 4,480,480 (Scott et al.) in view of Carter et al., *Automated 3-D Crack Growth Simulation*, Int. J. Numer. Meth. Engng. 47, 229-253 (2000), and further in view of European Patent Application No. 0 358 994 A¹ (Palusamy et al.). The rejection is traversed. The cited references fail to show or suggest at least steps i), ii), iv), v), vii), viii), and xi) of claim 49 and the corresponding features of claim 56. In more detail:

Claim 49 recites eleven numbered method steps.

i) Collecting data relating to initial dimensions of the structure.

At page 6, lines 3-4 of the Final action, the examiner cites to col. 11, line 66 – col. 12, line 1 and col. 16, line 64 – col 17, line 4 of Scott. Those passages explain that structures have natural modes of vibration and impulse responses, but do not disclose or suggest collecting data. This point does not appear to be addressed in the Examiner's response to Applicant's previous arguments.

ii) Creating a computer model of the structure.

At page 6, lines 4-5 of the Final action, the examiner cites to col. 11, lines 20-24 and col. 11, line 66 – col. 12, line 1 of Scott. The first of those passages, as noted above, describes the physics of structures, but does not disclose or suggest computer modeling. The second passage mentions "the exact mathematical modeling ... of potential new designs." There is no suggestion of modeling an actual structure. Any reading of claim 49, clause ii) broad enough to include Scott's models of potential new structures is excluded by the recitation in later clauses of claim 49 of inputting actual data into the model.

The Examiner addresses step ii) at page 15, line 14 to page 17, line 14 of the Final action, but largely fails to distinguish between a model of an actual structure, including actual data, and

a model of a potential structure, which necessarily includes only hypothetical data. At page 16, lines 9-12, the Examiner states that it “is understood by the Examiner that this set of natural frequencies and impulse response of the structure constitutes a computer model of the structure since they are indications of the behavior of the system.” Repeating this argument at page 17, line 9-11, the Examiner adds “and since it must be stored in a computer memory [in] order to be compared to the current natural frequency of impulse response sensed by the sensors.” The argument is repeated again on page 20 of the Final action. The Examiner’s understanding is incorrect. The natural frequencies are real physical phenomena, and do not constitute a computer model. The fact that one physical phenomenon can be used as a proxy for a second does not make the first phenomenon a model of the second, still less a computer model. Only with the benefit of impermissible hindsight could Scott’s use of easily detected vibration frequencies as a proxy for dimensions be seen as suggesting the creation of a computer model. It is possible to compare measurements at different times without storing the earlier measurement in a computer memory, and it is possible to store information in a computer memory without creating a computer model. The Examiner’s arguments are not supported by her facts.

iii) collecting data relating to an estimated load on the structure

At page 6, lines 6-7 of the Final action, the Examiner cites to col. 10, lines 18-20, col. 14, lines 13-33, and col. 17, lines 5-21 of Scott. The first of those passages mentions “load measurement” in the context of “warning of impending failure … due to loads which approach or exceed the design load.” The remaining passages relate to measuring the structural rigidity of an individual structural member as a proxy for its ability to carry its design load. These all appear to be real-time monitoring of actual loads for immediate action. There is no suggestion that these “load measurements” are suitable for use, or are used, as inputs to a computer model.

At page 17, line 15 to page 18, line 2, the Examiner argues that the “design load” is an “estimated load,” and that Scott’s ‘assessment of the ability of the structure to carry its design load’ is “data relating to an estimated load.” However, nothing can be identified in Scott that: is collected data; and relates to an estimated load; and is used as an input to an analysis of the structure as required in the next step of claim 49.

¹ Identified in the Office action by its application serial number, although the citations all appear to be to the A publication.

iv) analyzing the structure, using the computer model of the structure and the load data, in order to define high stress areas, in which areas of the structure future problems can be expected

At page 6, lines 7-12 of the Final action, the Examiner cites to col. 11, line 66 – col. 12, line 7, col. 12, lines 27-35, col. 13, lines 10-17 and 25-29, col. 20, lines 4-10 and 50; col. 21, lines 30-34 and 50-61, and col 22, lines 15-20. However, none of those passages teaches or suggests “to define high stress areas,” as claimed. They all start with an assumption that the SMD sensors are positioned on the components to be monitored. None of those passages describes or suggests to define areas in which future problems can be expected, as claimed. They all relate to real-time measurements detecting current problems. At page 18, lines 3-10 of the Final action, the Examiner points to col. 13, lines 25-29. However, that passage does not describe predicting a future problem; it describes identifying a present problem in an early stage of development. Certainly, none of the passages of Scott cited against step iv) suggests analysis using the data from any of the passages cited against step iii), as claimed.

v) installing sensors in the high stress areas

vi) measuring, after a time interval, dimensions of the structure in the high stress areas

The various passages of Scott cited at page 6, lines 12-16 of the Final action do not describe or suggest sensors installed in the high stress areas identified in step iv), as claimed.

At page 6, lines 12-16 of the Final action, the Examiner cites to Fig. 4, element 42, col. 10, lines 9-14, col. 16, col. 11, line 66 – col. 12, line 7, line 21, col. 17, lines 30-32, and col. 21, lines 50-52 of Scott. Col. 21, lines 50-52 describes positioning sensors along the entire pipeline. At page 18, line 11, to page 19, line 15 of the Final action, the Examiner argues that other passages refer to “critical points” and “strategically located” sensors, but Scott does not define his strategy or criticality. Even if the Examiner’s “understanding” that these are “areas of concern ... such as areas subjected to high loads or stresses” is correct (which is not admitted), there is no suggestion that they are identified in accordance with step iv) above. As far as can be determined from the actual disclosure of Scott, his sensors (when not distributed uniformly over the whole structure) may be positioned using prior art techniques relying on the experience and subjective judgment of the individual engineer. The Examiner also cites to col. 2, lines 34-42 and col. 3, lines 12-29 of Palusamy, but Palusamy explicitly uses prior art techniques (“a combination of design knowledge, experience and testing”). Even if the Examiner’s

“understanding” that the points where Palusamy installs sensors “have been identified as critical points,” Palusamy is merely cumulative of Scott, and does not disclose or suggest identifying the “critical” points as areas defined by the analysis of step iv) above.

At page 8, line 19 to page 9, line 18, the Examiner acknowledges that Scott does not teach measuring dimensions of the structure in the high strength areas, and cites to Palusamy, which describe monitoring the wall thickness of areas expected to be subject to erosion-corrosion. The Examiner argues that it would have been obvious to modify Scott by substituting the direct measurement of wall thickness, as taught by Palusamy, for the measurement of natural frequencies and impulse responses, as taught by Scott. However, this does not materially assist the Examiner, because the sensors would still not be installed in areas defined in accordance with step iv), as claimed.

vii) updating the computer model of the structure, using the results of step vi)

At page 6, lines 16-17 of the Final action, the Examiner cites to col. 10, lines 9-14 and col. 12, lines 1-7 of Scott. As noted previously, those paragraphs describe only real-time monitoring for immediate action, and neither disclose nor suggest updating a computer model.

Contradicting the position stated on page 6, the Examiner then appears to concede at page 7, line 13 to page 8, line 18 that Scott does not disclose updating a computer model with sensor data, and cites to Carter. Carter discloses a system for modeling the development of a crack. Carter does not disclose or suggest updating the computer model with measured data. The Examiner cites to Section 2, ¶ 1, lines 1-3, ¶ 3, and ¶ 4, lines 1-2, but those passages describe only a computational update within the model. See Equation (3) on page 231 (between the passages identified as Section 2, ¶¶ 3 and 4), which defines the Update Function **U**. In any case, Carter teaches only a model for simulating a single crack. Incorporating Carter’s model into Scott would not fairly suggest the modeling and monitoring of an overall structure as required by the language of at least steps ii), iv), v), viii), and xi) of claim 49. The Examiner then concedes at page 8, lines 19-20 of the Final action that neither Scott nor Carter teaches measuring dimensions of the structure in high-stress areas, leaving it unclear just what measured data Carter is alleged to use.

At page 19, line 16 to page 20, line 17, the Examiner purports to reply to Applicants’ previous arguments, but it is noted that most of that passage is an identical copy of the

Examiner's argument in respect of step i), which has already been refuted. The one new sentence appears to be addressed to step xi) of the claim, and is discussed below.

viii) installing, in the high stress areas, a second set of sensors for measuring the load on the structure in said high stress areas

At page 6, lines 17-20 of the Final action, the Examiner cites to the same passages of Scott that were cited against the first set of sensors in step v). At page 18, line 11 to page 19, line 3, the Examiner argues that Scott teaches "a plurality of sensors ... wherein it is understood that these plurality of sensors encompass a first and second set of sensors." That is not sufficient to support the rejection. Step v) recites first sensors for measuring dimensions, and step viii) recites second sensors for measuring load. On step v), the Examiner has argued that it is obvious to substitute dimension sensors from Palusamy for Scott's original sensors. The Examiner nowhere even alleges that it would have been obvious to provide load sensors *and* dimension sensors, as claimed.

ix) measuring the actual load on the structure

x) updating the data relating to the load on the structure

At page 6, lines 20-21 of the Final action, the Examiner cites to col. 10, lines 9-23 and col. 14, lines 13-46 of Scott. It is noted that both of those passages discuss load measurement only for immediate use, as a way "to predict impending failure." There is no suggestion of longer-term use of the data.

xi) re-analyzing the structure, using the updated computer model and the updated load data, in order to calculate a value for the integrity of the structure.

At page 6, line 22 to page 7, line 2 of the Final action, the Examiner cites to col. 10, lines 9-23 and 56-62 of Scott. In addition, at page 20, lines 11-17, the Examiner cites to col. 12, lines 1-7 of Scott. The Examiner "understands" that a model is continuously updated with the new measured data that "reflect the changing physical dimensions of the structure." There is no support in Scott for the Examiner's "understanding." The only place in the cited passages where the data are processed at all is col. 10, lines 56-62, and that passage merely describes reformatting the data into a form suitable for storage, display, or manual editing. There is no suggestion of updating a model. The Examiner nowhere even alleges that it would have been obvious to use the data from dimension sensors to update a model *and* to combine the updated model with the data from load sensors, as claimed.

For all of the above reasons, claim 49 is believed to be non-obvious over the cited references.

Claim 57 is an apparatus claim corresponding to the method of claim 49, and is deemed to be non-obvious over the cited references for generally the same reasons as claim 49.

Claims 50-54, 56, 58-59, and 61-66 are dependent from claims 49 and 57 and, without prejudice to their individual merits, are deemed to be allowable over the cited references for at least the same reasons as claim 49.

In addition, with reference to claim 54, no reference to estimating a minimum size of defects is found in the cited references. Palusamy, col. 3, lines 12-25 measures the wall thickness, but does not estimate anything. Carter, section 4, ¶ 1 and section 4.1, ¶ 1-2, mentions that initial cracks may be “quite small,” but seems to use the actual size of crack, however small. Carter is concerned with a single crack, and cannot even consider the “minimum size of defects in the structure,” because he neither knows nor cares what other cracks there are.

With reference to claims 59 and 64, Scott describes a pressure transducer and an accelerometer, but does not actually describe or suggest using it to measure pressure exerted on or acceleration experienced by a structure that is being monitored. He is simply showing off the versatility of his measuring device.

Claim 55 is rejected as allegedly obvious over Scott, Carter, and Palusamy as applied to claim 54, and further in view of U.S. Patent No. 6,955,100 (Barich et al.). Claim 55 is dependent from claim 54, and Barich is relied on only for additional features of claim 55. Claim 55 is therefore deemed to be non-obvious over the combination of four references for at least the same reasons as claims 49 and 54 are non-obvious over the first three references. In addition, the cited passages from Barich do not describe or suggest estimating a minimum defect size for use in a model. They describe only determining an actual defect size and immediately assessing the defect as tolerable or intolerable. The minimum *intolerable* defect must be larger than the precision of the measuring instrument, but that does not involve estimating the minimum *actual* defect size.

Claim 60 is rejected as allegedly obvious over Scott, Carter, and Palusamy as applied to claim 57, and further in view of U.S. Patent No. 5,867,977 (Zachary). Claim 60 is dependent from claim 57, and Barich is relied on only for additional features of claim 60. Claim 60 is

therefore deemed to be non-obvious over the combination of four references for at least the same reasons as claim 57 is non-obvious over the first three references.

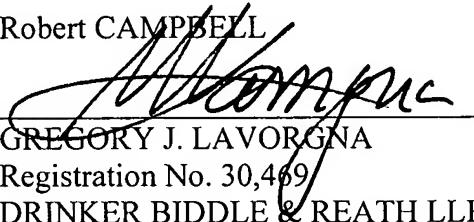
Conclusion:

In view of the foregoing, all of claims 49-66 are believed to be allowable. Applicant respectfully requests reconsideration and withdrawal of the examiner's objections and rejections, and allowance of claims 49-66. An early notice of allowance is respectfully solicited. If the Examiner believes, however, that direct communication would advance prosecution, the Examiner is invited to telephone Henry Blanco White, telephone no. 215-988-3301.

Respectfully submitted,

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